REMARKS

The Office Action dated July 3, 2007 has been received and carefully noted. The above amendments to the claims, and the following remarks, are submitted as a full and complete response thereto.

In accordance with the foregoing, claims 3 and 7 have been amended to improve clarity of the features recited therein. No new matter is being presented, and approval and entry are respectfully requested. As will be discussed below, it is also requested that all of claims 1-8 be found allowable as reciting patentable subject matter.

Claims 1-8 are pending and under consideration.

REJECTION UNDER 35 U.S.C. § 101:

In the Office Action, at page 2, claim 7 was rejected under 35 U.S.C. § 101 because the invention is directed to non-statutory subject matter.

In response, claim 7 has been amended to more particularly point out and distinctly claim the invention

Accordingly, it is respectfully requested that the § 101 rejection to the claims be withdrawn.

REJECTION UNDER 35 U.S.C. § 112:

In the Office Action, at page 2, claim 3 was rejected under 35 U.S.C. § 112, second paragraph, for indefiniteness.

In response, claim 3 has been amended to improve clarity and antecedent support.

Accordingly, it is respectfully requested that the § 112, second paragraph rejection to claim 3 be withdrawn.

REJECTION UNDER 35 U.S.C. § 103:

On page 3 of the Office Action, claims 1-2 and 4-8 were rejected under 35 U.S.C. § 103 as being unpatentable over U.S. Patent 6,621,805 to Kondylis ("Kondylis") in view of U.S. Patent No. 6,618,385 to Cousins ("Cousins") and U.S. Patent No. 6,628,670 to Galand ("Galand"). The Office Action took the position that Kondylis, Cousins, and Galand disclose all the aspects of independent claims 1 and 6-8. The rejection is traversed and reconsideration is requested.

Independent claim 1, upon which claims 2-5 are dependent, recites a method of allocating bandwidth in a first node that is operable in an ad hoc, wireless network configured to support at least one guaranteed feasible flow allocation. The method includes initiating a communication between the first node and a second node in the network that, together, are endpoints of a link, the communication being related to possible bandwidth allocation adjustment of a flow sharing the link. The method determines, in the first node, a first new bandwidth allocation that approaches a first optimization condition for the flow, and communicates with the second node to determine a mutually-agreed upon optimal bandwidth allocation for the flow. The method notifies neighbor nodes in the network of the mutually-agreed upon optimal

bandwidth allocation when reallocation is needed, and adopts the mutually-agreed upon optimal allocation for the flow when reallocation is needed.

Independent claim 6 recites a network device configured to allocate bandwidth in an ad hoc, wireless network configured to support at least one guaranteed feasible flow allocation. The device includes a first communication unit configured to initiate a communication between the device and a node in the network that, together, are endpoints of a link in the network, the communication being related to possible bandwidth allocation adjustment of a flow sharing the link. The device also includes a first processing unit configured to determine a first new bandwidth allocation that approaches a first optimization condition for the flow, wherein the first processing unit is operably connected to the first communication unit, and a second communication unit configured to communicate with the node to determine a mutually-agreed upon optimal bandwidth allocation for the flow, wherein the second communication unit is operably connected to the first communication unit. The device also includes a third communication unit configured to notify neighbor nodes in the network of the mutually-agreed upon optimal bandwidth allocation when reallocation is needed, wherein the third communication unit is operably connected to the first communication unit, and a second processing unit configured to adopt the mutually-agreed upon optimal allocation for the flow when reallocation is needed, wherein the second processing unit is operably connected to the first communication unit.

Independent claim 7 recites a computer program embodied on a computer readable medium to allocate bandwidth in an ad hoc, wireless network configured to support at least one guaranteed feasible flow allocation. The computer program being configured to control a processor to perform: a first sub-routine for initiating a communication between the first node and a second node in the network that, together, are endpoints of a link, the communication being related to possible bandwidth allocation adjustment of a flow sharing the link. The computer program is also configured to control a processor to perform a second sub-routine for determining, in the first node, a first new bandwidth allocation that approaches a first optimization condition for the flow, a third sub-routine for communicating with the second node to determine a mutually-agreed upon optimal bandwidth allocation for the flow, and a fourth sub-routine for notifying neighbor nodes in the network of the mutually-agreed upon optimal bandwidth allocation when reallocation is needed. The computer program is configured to control a processor to perform a fifth sub-routine for adopting the mutually-agreed upon optimal allocation for the flow when reallocation is needed.

Independent claim 8 recites a network device configured to allocate bandwidth in an ad hoc, wireless network configured to support at least one guaranteed feasible flow allocation. The device includes initiation means for initiating a communication between the first node and a second node in the network that, together, are endpoints of a link, the communication being related to possible bandwidth allocation adjustment of a flow sharing the link, and determination means for determining, in the first node, a first new

bandwidth allocation that approaches a first optimization condition for the flow. The device includes determination means for communicating with the second node to determine a mutually-agreed upon optimal bandwidth allocation for the flow, and notification means for notifying neighbor nodes in the network of the mutually-agreed upon optimal bandwidth allocation when reallocation is needed. The device also includes adoption means for adopting the mutually-agreed upon optimal allocation for the flow when reallocation is needed.

An implementation of the current invention provides a configuration of a multi-hop wireless ad hoc network that operates with a network schedule of period T time slots. At each slot of this schedule a set of non-interfering links are scheduled to transmit simultaneously. The number of such conflict-free time slots each link receives within the period T determines its allocated bandwidth.

The network schedule is realized by local schedules of T-slots at the wireless nodes. The local schedule of each node may include T slots. Each time slot tells the node which channel and link this node should transmit or receive. In order for successful communication to occur on a link at a particular slot, the local schedules of the endpoint nodes should be such that one node starts transmitting and the other node starts receiving on this particular slot at the same time and channel.

Embodiments of the present invention solve the problem of realizing a globally optimal bandwidth allocation on all links in the network through an incremental algorithm where nodes may start from an initial schedule (realizing a sub-optimal

bandwidth allocation) and locally readjust the bandwidth on their adjacent links through time slot reassignments until the nodes reach a global time-slotted schedule that realizes a globally optimal allocation for all links in the wireless ad hoc network.

Each link is asynchronously activated for bandwidth adjustment at mutually agreed intervals of its endpoint nodes. When a link is activated for bandwidth adjustment, one of the endpoint nodes performs a local computation for a potential allocation of bandwidth to the link. This reallocation may take away bandwidth (time slots) from the adjacent links of this node. This is due to the half-duplex nature of wireless nodes, which requires links adjacent to a node be activated on different slots. A similar local computation is performed at the other endpoint node of the link. Then the two nodes agree on the both the amount of bandwidth (number of slots) and which time slots should be allocated to this link. Then the two node endpoints notify their neighbor nodes on their other adjacent links about how much bandwidth (how many slots) they should deallocate and which slots they should cancel in their own local schedules from these links. This notification step essentially tells the neighbors to reallocate bandwidth on the links they were notified from. The notification step is necessary because two nodes can communicate in a slot only if both are tuned to this slot in their local schedules.

Kondylis, Cousins, and Galand fail to disclose or suggest the elements of any of the presently pending claims, and therefore fail to provide the advantages and features discussed above.

Kondylis generally describes a real-time multicast scheduler to avoid packet collisions and to facilitate color re-use, where "color" is defined as a channel selected as a combination of time-division multiple access, frequency-division multiple access, and code division multiple access schemes.

Essentially, the Office Action used the descriptions of Kondylis as describing the features recited in the preamble of independent claim 1. However, the Office Action appears to have misconstrued, at least, "wireless network configured to support at least one guaranteed feasible flow allocation." As required by current U.S. patent rules and procedures, the features recited in a claim are to be construed in light of the specification. In this instance, as set forth in the specification of the present application, a bandwidth allocation of flows is called feasible if there exists a conflict-free schedule that allocates to every flow. Kondylis appears to describe "adapt the reserved bandwidth according to traffic fluctuation," which is construed by the Office Action as being "guaranteed feasible because it dynamically adapts." As clearly set forth in the specification of the present application, the guaranteed feasible flow allocation of independent claim 1 is not related to dynamic adaptation.

Furthermore, as correctly recognized in the Office Action, Kondylis fails to teach or suggest all the steps recited in the method of independent claim 1. Accordingly, the Office Action relied on Cousins as describing such steps.

Cousins generally describes a network initialization process to determine the maximum available data transfer throughput, optimized bandwidth, and optimized

transfer conditions in a **wired** network. <u>See</u> column 3, lines 42-58. Specifically, the network initialization process also negotiates the number of twisted pair wires to use, detects and identifies scrambled wires, determines the compression scheme to use, etc. These parameters are then utilized in a predetermined well known modulation communications technique such as spread spectrum or Quadrature Amplitude Modulation (QAM) to accordingly adjust the data transfer rate between the two devices.

If no such acknowledgment response is received in Cousins, the source interface adapter continues its monitoring. <u>See</u> column 7, lines 11-16. Otherwise, interface adapter 200 of the designated DTE communicates with interface adapter 200 of the designated DCE regarding the various measurements, analyses, and optimizing techniques that must be coordinated and carried out between interface adapters 200 of the designated DTE and DCE to determine the parameters discussed earlier (step 405).

Also, the negotiation session of Cousins seeks to establish the data transfer scheme between the two machines (e.g., **how data is transferred over various twisted pair wires**) and to determine the best use of the available bandwidth. Accordingly, part of this negotiation includes the selection of compression algorithms for use in the data transfer. Moreover, the negotiation further includes reservation of part of the bandwidth for isocronous data and/or other non-LAN uses such as streaming video. <u>See</u> column 7, lines 40-52.

However, contrary to the contentions made in the Office Action, Cousins does not remedy the deficiencies of Kondylis. Cousins does not teach or suggest a method for an

"ad hoc wireless network configured to support at least one guaranteed feasible flow allocation," as recited in independent claim 1. **Rather, Cousins is for wired local area (LAN) networks instead of wireless ad hoc networks.** In wireless networks links interfere and, hence, bandwidth allocation on one link affects other links. Cousins also fails to teach or suggest, at least, "initiating a communication between the first node and a second node in the network that, together, are endpoints of a link, the communication being related to possible ***bandwidth allocation adjustment of a flow*** sharing the link," emphasis added, as recited in independent claim 1. Rather, Cousins performs "network *initialization* process *prior to the data transfer*" and focuses on a determination of a set of optimal transmission parameters ***for a single link***.

In addition, a person of ordinary skill would not be motivated to combine the descriptions of both, Kondylis and Cousins. MPEP 2143.01(V) states "THE PROPOSED MODIFICATION CANNOT RENDER THE PRIOR ART UNSATISFACTORY FOR ITS INTENDED PURPOSE," (Capital letters in original.) and explains that "If proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification." Moreover, MPEP 2145(III) states that "the claimed combination cannot change the principle of operation of the primary reference or render the reference inoperable for its intended purpose." The proposed combination would change the fundamental principles of Kondylis' operation, and, thus, is *per se* non-obvious under MPEP 2143.01(V). For instance, Kondylis is directed to a wireless ad-hoc network,

where, in contrast, Cousins is configured **for a wired local area (LAN) network**. The configurations of Kondylis and Cousins have different configurations and applications, such that, a person of ordinary skill in the art would not be motivated to combine both references as one reference would render the other inoperable for its intended purpose.

Therefore, a combination of Kondylis and Cousins is improper.

Referring to Galand, this reference generally describes routing path selection and bandwidth reservation to connections sharing a path in a packet switched ***wireline*** communication network. Galand further provides exchanging of information (109) between the origin (access) node (100), the transit nodes (107) on the path, and the destination node (108). (104) Bandwidth Reservation replies from transit nodes and end node generate either a call acceptance or a call reject (110). (105) a Link Metric Update process updates, in case of call acceptance, the modified link metrics. This information (111) is sent through the Control Spanning Tree to the Topology Database of each node in the network by means of a broadcast algorithm.

In contrast, independent claim 1 recites, in part, "A method of allocating bandwidth in a first node that is operable in ***an ad hoc, wireless network*** configured to support at least one guaranteed feasible flow allocation...comprising...initiating a communication between the first node and a second node in the network that, together, are endpoints of a link, the communication being related to possible bandwidth allocation ***adjustment of a flow sharing the link***." (Emphasis added) In contrast, Galand refers to connections sharing **wireline** paths. In the present application, the bandwidth allocation

of a flow on one link of a wireless node depends on the bandwidth allocations of flows on other adjacent links of this node. In Galand's wireline case, each link is an independent resource for connections sharing it. Furthermore, for similar reasons as those previously provided for Cousins, a person of ordinary skill in the art would not have been motivated to combine the teachings of Galand with that of Kondylis as the first reference refers to wireline paths where Kondylis refers to wireless network.

Therefore, Galand fails to cure the deficiencies of Kondylis and Cousins. A combination of Kondylis, Cousins, and Galand would fail to teach or suggest the initiating, determining, communicating, and notifying steps of independent claim 1 and related dependent claims.

Because independent claims 6-8 include similar claim features as those recited in independent claim 1, although of different scope, and because the Office Action refers to similar portions of the cited reference to reject independent claims 6-8, the arguments presented above supporting the patentability of independent claim 1 in view of Kondylis, Cousins, and Galand are incorporated herein to support the patentability of independent claim 6-8.

Accordingly, Applicant respectfully request that independent claims 1 and 6-8 and related dependent claims be allowed.

On page 13 of the Office Action, claim 3 was rejected under 35 U.S.C. § 103 as being unpatentable over U.S. Patent 6,621,805 to Kondylis ("Kondylis") in view of U.S.

Patent No. 6,618,385 to Cousins ("Cousins") and U.S. Patent No. 6,628,670 to Galand ("Galand") and further in view of U.S. Patent No. 6,724,727 to Counterman ("Counterman"). The Office Action took the position that Kondylis, Cousins, Galand, and Counterman disclose all the aspects of claim 3. The rejection is traversed and reconsideration is requested.

Because the combination of Kondylis, Cousins, and Galand must teach, individually or combined, all the recitations of the base claim and any intervening claims of dependent claim 3, the arguments presented above supporting the patentability of independent claim 1 over Kondylis, Cousins, and Galand are incorporated herein.

Counterman generally describes a method and apparatus for a communications system that prioritizes packets that are transmitted over a digital communication channel utilizing at least one error-correcting transmission path associated with a Quality of Service (QoS) objective. The QoS objective is used to select the appropriate transmission path (that may include forward error coding, scrambling, and interleaving) that satisfies the relevant metrics of the desired level of service quality such as packet latency, variation of the packet latency, information throughput, and packet error rate (PER). The communications system selects a transmission path that is associated with QoS objectives best matched to the QoS objectives as required by the originating application.

However, contrary to the contentions made in the Office Action, Counterman does not cure the deficiencies of Kondylis, Cousins, and Galand. Similarly to Kondylis, Cousins, and Galand, Counterman is devoid of any teaching or suggestion providing, at

least, “a method of allocating bandwidth in a first node that is operable in an ad hoc, wireless network configured to support at least one guaranteed feasible flow allocation, the method comprising the steps of: initiating a communication between the first node and a second node in the network that, together, are endpoints of a link, the communication being related to possible bandwidth allocation adjustment of a flow sharing the link,” as recited in independent claim 1. Rather, Counterman simply refers to forward error correction in packet networks and not transmission scheduling and bandwidth allocation in wireless ad hoc networks. Also, Counterman simply refers to QoS objectives on a single link, which has no bearing in the features recited in independent claim 1. For similar reasons, a combination of Kondylis, Cousins, Galand, and Counterman would fail to teach or suggest the determining, communicating, and notifying steps recited in independent claim 1.

Accordingly, Kondylis, Cousins, Galand, and Counterman, individually or combined, fail to teach or suggest all the recitations of independent claim 1 and related dependent claim 3.

CONCLUSION:

In view of the above, Applicant respectfully submits that the claimed invention recites subject matter which is neither disclosed nor suggested in the cited prior art. Applicant further submits that the subject matter is more than sufficient to render the claimed invention unobvious to a person of skill in the art. Applicant therefore

respectfully requests that each of claims 1-8 be found allowable and this application passed to issue.

If for any reason the Examiner determines that the application is not now in condition for allowance, it is respectfully requested that the Examiner contact, by telephone, the applicant's undersigned attorney at the indicated telephone number to arrange for an interview to expedite the disposition of this application.

In the event this paper is not being timely filed, the Applicant respectfully petitions for an appropriate extension of time. Any fees for such an extension together with any additional fees may be charged to Counsel's Deposit Account 50-2222.

Respectfully submitted,

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